

Application No. 10/627,575

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IN THE CLAIMS

1. (Currently amended) A storage apparatus that operates in response to commands from a computer, the storage apparatus comprising:

a storage region; and

a control unit that operates in response to a first command that ~~correlates~~ snaps a first storage region in the storage region ~~[[to]]~~ and a second storage region in the storage region into a snap state in which said first and second storage regions form a pair having a master-slave control relationship, and while said first and second storage regions are in said snap state, allows in response to a read instruction to read data in the second storage region copying of the data from the first storage region to the second storage region in response to a read instruction to read data in the second storage region, and in response to a second command that dissolves the ~~correlation~~ snap state between the first storage region and the second storage region.

2. (Currently amended) A storage apparatus according to claim 1, wherein, when controlling the copying of data, the control unit reads data from the first storage region, outputs

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the data read to the computer, and then writes the data ~~read~~ to the second storage region.

3. (Original) A storage apparatus according to claim 1, wherein, when there is data copied from the first storage region to the second storage region, the control unit invalidates the data in response to the first command.

4. (Original) A storage apparatus according to claim 1, wherein the first command is a command that allows copying of data from the first storage region to the second storage region in response to a write instruction to the second storage region.

5. (Original) A storage apparatus according to claim 4, wherein the control unit writes data designated by the write instruction on the data copied to the second storage region.

6. (Original) A storage apparatus according to claim 5, wherein the control unit controls in response to the second command to copy the data designated by the write instruction and written in the second storage region to the first storage region.

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7. (Currently amended) A storage apparatus according to claim 4, wherein the control unit controls the storage apparatus, in response to the second command, to copy the data from the first storage region to a region in the second storage region where data ~~is not~~ has not been copied from the first storage region.

8. (Currently amended) A storage apparatus according to claim 1, wherein the control unit controls the storage apparatus, in response to the second command, to copy the data from the first storage region to a region in the second storage region where data ~~is not~~ has not been copied from the first storage region.

9. (Currently amended) A storage apparatus according to claim 1, wherein the control unit generates, in response to the first command, management information to manage ~~correlation~~ the snap state between the first storage region and the second storage region, and to release the management information in response to the second command.

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10. (Currently amended) A storage apparatus according to claim 1, wherein the control unit includes a control module that is responsive to a third command to control copying data from the first storage region to a region of the second storage region where data ~~is not~~ has not been copied from the first storage region, and to control dissolving the ~~correlation snap state~~ between the first storage region and the second storage region.

11. (Original) A storage apparatus according to claim 10, wherein the control unit is responsive to the second command and the third command selectively issued from the computer.

12. (Currently amended) A storage apparatus that operates in response to commands from a computer, the storage apparatus comprising:

a storage region; and

a control unit that operates in response to a first command that causes a first storage region within the storage region to ~~be correlated to~~ enter a snap state with a second storage region within the storage region, wherein in said snap state said first and second storage regions form a pair having

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a master-slave control relationship; that while said first and second storage regions are in said snap state, allows in response to a read instruction to read data in the second storage region copying of the data from the first storage region to the second storage region in response to a read instruction to read data in the second storage region; [[,]] allows in response to a write instruction to the second storage region, writing of data instructed in the write instruction to the second storage region; [[,]] and controls copying the data written in the second storage region to the first storage region.

13. (Original) A storage apparatus according to claim 12, wherein, when controlling the copying of the data in response to the read instruction, the control unit reads the data from the first storage region, outputs the data read to the computer, and then writes the data read in the second storage region.

14. (Original) A storage apparatus according to claim 12, wherein the control unit controls the copying of the data written in the first storage region in response to a second command.

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15. (Original) A storage apparatus according to claim 12, wherein the control unit controls in response to the first command copying of data of the first storage region to the second storage region designated by the write instruction before writing the data designated by the write instruction.

16. (Currently amended) A storage apparatus according to claim 12, wherein, when there is data in the second storage region that has been copied from the first storage region ~~to the second storage region~~, the control unit controls in response to the first command to invalidate the data that has been copied.

17. (Currently amended) A storage apparatus according to claim 12, wherein the control unit is responsive to a third command to control dissolving of the ~~correlation~~ snap state between the first storage region and the second storage region.

18. (Currently amended) A storage apparatus according to claim 17, wherein the control unit generates, in response to the first command, management information to manage

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~~correlation~~ the snap state between the first storage region and the second storage region, and dissolves the management information in response to the third command ~~the management information~~.

19. (Currently amended) A storage apparatus comprising:
a storage region; and
a control unit that controls transfer between a first control state, that ~~correlates~~ snaps a first storage region within the storage region to a second storage region within the storage region into a snap state in which said first and second storage regions form a pair having a master-slave control relationship, and while said first and second storage regions are in said snap state, ~~allows in response to a read instruction to read data in the second storage region copying~~ of the data from the first storage region to the second storage region in response to a read instruction to read data in the second storage region; and a second control state, that dissolves the ~~correlation~~ snap state between the first storage region and the second storage region.

20. (Currently amended) A storage apparatus according to claim 19, wherein, when controlling the copying of data,

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the control unit reads data from the first storage region, outputs the data read to a host computer, and then writes the data read to the second storage region.

21. (Original) A storage apparatus according to claim 19, wherein the control unit controls, in the first control state, in response to a write instruction to the second storage region, to allow copying of data from the first storage region to the second storage region.

22. (Currently amended) A storage apparatus according to claim 19, wherein, when transferring from the first control state to the second control state, the control unit controls copying of data from the first storage region to a region in the second storage region where data ~~is not~~ has not been copied from the first storage region.

23. (Currently amended) A storage apparatus according to claim 19, wherein, when transferring from the first control state to the second control state, the control unit controls copying of data from the second storage region to a region in the first storage region where data ~~is not~~ has not been copied from the second storage region.

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24. (Currently amended) A storage apparatus according to claim 19, wherein, when transferring from the first control state to the second control state, the control unit generates management information to manage ~~correlation~~ the snap state between the first storage region and the second storage region, and when transferring from the second control state to the first control state, the control unit releases the management information.

25. (Currently amended) A method for managing a storage apparatus having a storage region, the method comprising the steps of:

in response to a first command from a computer,
~~correlating~~ snapping a first storage region in the storage region ~~[[to]]~~ and a second storage region in the storage region into a snap state in which said first and second storage regions form a pair having a master-slave control relationship, and while said first and second storage regions are in said snap state, copying data from the first storage region to the second storage region in response to a read instruction from the computer to read the data in the second storage region; and

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in response to a second command, dissolving the ~~correlation~~ snap state between the first storage region and the second storage region.

26. (Original) A method for managing a storage apparatus according to claim 25, wherein the step of copying the data comprises the steps of reading data from the first storage region, outputting the data read to the computer, and then writing the data read to the second storage region.

27. (Currently amended) A method of managing a storage apparatus according to claim 25, wherein, when there is data in the second storage region that has been copied from the first storage region ~~to the second storage region~~, the data is invalidated in response to the first command.

28. (Original) A method of managing a storage apparatus according to claim 27, wherein, in response to a write instruction to the second storage region, data is copied from the first storage region to the second storage region.

29. (Original) A method of managing a storage apparatus according to claim 28, wherein data designated by the write

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instruction is written on the data copied to the second storage region.

30. (Original) A method of managing a storage apparatus according to claim 29, wherein, in response to the second command, the data designated by the write instruction and written in the second storage region is copied to the first storage region.

31. (Currently amended) A method of managing a storage apparatus according to claim 29, wherein, in response to the second command, the data is copied from the first storage region to a region in the second storage region where data ~~is~~ has not been copied from the first storage region.

32. (Currently amended) A method of managing a storage apparatus according to claim 25, wherein, in response to the second command, the data is copied from the first storage region to a region in the second storage region where data ~~is~~ has not been copied from the first storage region.

33. (Currently amended) A method of managing a storage apparatus according to claim 25, wherein management

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information to manage ~~correlation~~ the snap state between the first storage region and the second storage region is generated in response to the first command, and the management information is released in response to the second command.

34. (Currently amended) A method of managing a storage apparatus according to claim 25, wherein the control unit copies data from the first storage region to a region of the second storage region where data ~~is not~~ has not been copied from the first storage region, and dissolves the ~~correlation~~ snap state between the first storage region and the second storage region in response to a third command.

35. (Original) A method of managing a storage apparatus according to claim 34, further comprising the step of responding to the second command and the third command selectively issued from the computer.

36. (Currently amended) A method for managing a storage apparatus having a storage region, the method comprising the steps of:

~~correlating~~ snapping a first storage region within the storage region [[to]] and a second storage region within the

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storage region[[,]] into a snap state in which said first and second storage regions form a pair having a master-slave control relationship;

in response to a read instruction from a computer to read data in the second storage region, and while said first and second storage regions are in said snap state, copying the data from the first storage region to the second storage region;

in response to a write instruction from the computer to the second storage region, writing data instructed in the write instruction to the second storage region; and

copying the data written in the second storage region to the first storage region.

37. (Original) A method for managing a storage apparatus according to claim 36, wherein the step of copying the data comprises the steps of: reading the data from the first storage region, outputting the data read to the computer, and then writing the data read in the second storage region.

38. (Original) A method for managing a storage apparatus according to claim 36, wherein the step of copying

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the data written to the first storage region is executed in response to a command from the computer.

39. (Currently amended) A method for managing a storage apparatus according to claim 36, wherein, before writing the data designated by the write instruction, data of the first storage region is copied to the second storage region designated by the write instruction.

40. (Currently amended) A method for managing a storage apparatus according to claim 36, further comprising the step of controlling, in response to a command from the computer, when there is data in the second storage region that has been copied from the first storage region ~~to the second storage region~~, to invalidate the data.

41. (Currently amended) A method for managing a storage apparatus according to claim 36, wherein the ~~correlation snap~~ state between the first storage region and the second storage region is dissolved in response to a command from the computer.

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42. (Currently amended) A method for managing a storage apparatus according to claim 41, wherein the step of ~~correlating~~ snapping the first storage region to the second storage region includes the step of generating management information to manage ~~correlation~~ the snap state between the first storage region and the second storage region, wherein the management information is released in response to the command.

43. (Currently amended) A method for managing a storage apparatus having a storage region, the method comprising the steps of:

controlling transfer between a first control state in which a first storage region within the storage region ~~is~~ correlated to and a second storage region within the storage region are snapped into a snap state in which said first and second storage regions form a pair having a master-slave control relationship, and a second control state in which the ~~correlation~~ snap state between the first storage region and the second storage region is dissolved; and

in the first control state, in response to a read instruction to read data in the second storage region, copying

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the data from the first storage region to the second storage region.

44. (Original) A method for managing a storage apparatus according to claim 43, wherein the step of copying the data includes the steps of reading the data from the first storage region, outputting the data read to a host computer, and then writing the data read to the second storage region.

45. (Original) A method for managing a storage apparatus according to claim 43, wherein, in the first control state, in response to a write instruction to the second storage region, data is copied from the first storage region to the second storage region.

46. (Currently amended) A method for managing a storage apparatus according to claim 43, wherein, when transferring from the first control state to the second control state, data is copied from the first storage region to a region in the second storage region where data ~~is not~~ has not been copied from the first storage region.

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47. (Currently amended) A method for managing a storage apparatus according to claim 43, wherein, when transferring from the first control state to the second control state, data is copied from the second storage region to a region in the first storage region where data ~~is not~~ has not been copied from the second storage region.

48. (Currently amended) A method for managing a storage apparatus according to claim 43, wherein, when transferring from the first control state to the second control state, management information to manage ~~correlation~~ the snap state between the first storage region and the second storage region is generated, and when transferring from the second control state to the first control state, the management information is released.

49. (Currently amended) A storage apparatus comprising:
a storage region, wherein a first storage region within the storage region and a second storage region within the storage region are ~~correlated and controlled in a first state~~ snapped into a first snap state in which said first and second storage regions form a pair having a master-slave control relationship, and the first storage region and the second

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storage region are controlled with the ~~correlation~~ snap state therebetween being dissolved in a second state; and

a control unit that selectively executes a first control mode which dissolves the ~~correlation~~ snap state in order to transfer from the ~~first~~ snap state to the second state and a second control mode which dissolves the ~~correlation~~ snap state after copying data in the first storage region to the second storage region.

50. (Currently amended) A storage apparatus comprising:

a storage region, wherein a first storage region within the storage region and a second storage region within the storage region are ~~correlated and controlled in a first state~~ snapped into a first snap state in which said first and second storage regions form a pair having a master-slave control relationship, and the first storage region and the second storage region are controlled with the ~~correlation~~ snap state therebetween being dissolved in a second state; and

a control unit that selectively executes a first control mode which dissolves the ~~correlation~~ snap state in order to transfer from the ~~first~~ snap state to the second state and a second control mode which dissolves the ~~correlation~~ snap state

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after copying data in the second storage region to the first storage region.

51. (Currently amended) A storage apparatus comprising:
a storage region;
a memory storing management information; and
a control unit that commonly uses the management information stored in the memory as control information for managing ~~correlation~~ a snap state between a first storage region within the storage region and a second storage region within the storage region in which said first and second storage regions form a pair having a master-slave control relationship, and as control information for managing ~~correlation~~ the snap state of a data status resulting from accesses to data in the first storage region with a data status resulting from accesses to data in the second storage region, and manages the first storage region and the second storage region that store the data.

52. (Currently amended) A method for controlling a storage apparatus comprising the steps of:

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controlling primary and secondary volumes as a pair in a snap state in which said primary and secondary volumes have a master-slave control relationship; and

using a logical snapshot management table that indicates which one of the primary and secondary volumes data to be accessed is retained to thereby access to a logical frozen image.